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# Phonon assisted resonant tunnelling and its phonons control

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## Abstract

© 2016 Pleiades Publishing, Inc.We observe a series of sharp resonant features in the tunnelling differential conductance of InAs quantum dots. We found that dissipative quantum tunnelling has a strong influence on the operation of nano-devices. Because of such tunnelling the current-voltage characteristics of tunnel contact created between atomic force microscope tip and a surface of InAs/GaAs quantum dots display many interesting peaks. We found that the number, position, and heights of these peaks are associated with the phonon modes involved. To describe the found effect we use a quasi-classical approximation. There the tunnelling current is related to a creation of a dilute instanton-anti-instanton gas. Our experimental data are well described with exactly solvable model where one charged particle is weakly interacting with two promoting phonon modes associated with external medium. We conclude that the characteristics of the tunnel nanoelectronic devices can thus be controlled by a proper choice of phonons existing in materials, which are involved.

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